



Federal Agency for
Cartography and Geodesy

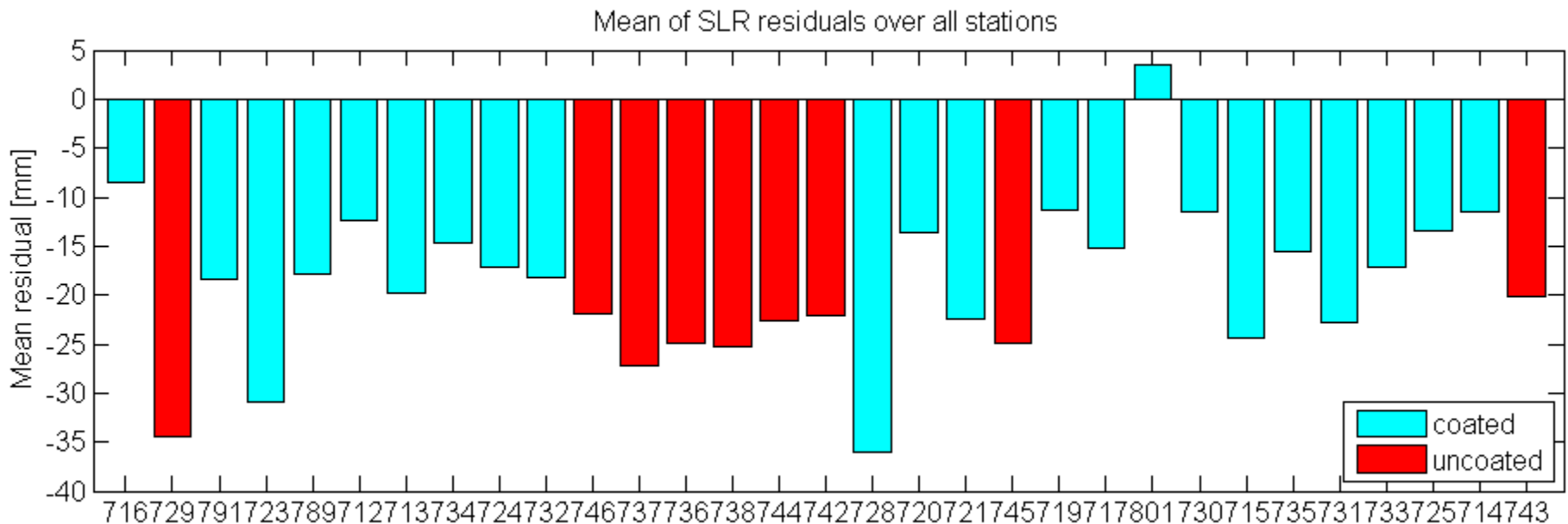
SLR Tracking of GNSS Satellites: Requirements by IERS

Meeting of the ILRS Study Group “LARGE”

Vienna, April 28, 2014

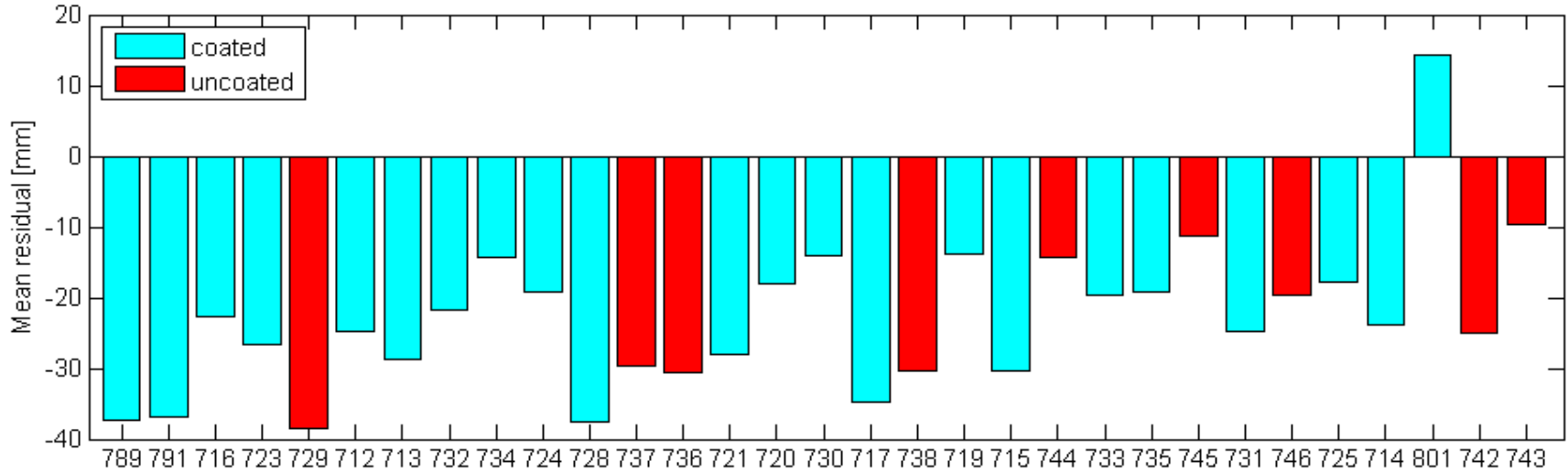
Network

- Stations should track also „standard“ SLR satellites (i.e., LAGEOS)
- Monitoring of station-specific biases is needed
- Monitoring of data quality is needed (e.g. reports sent by CODE)

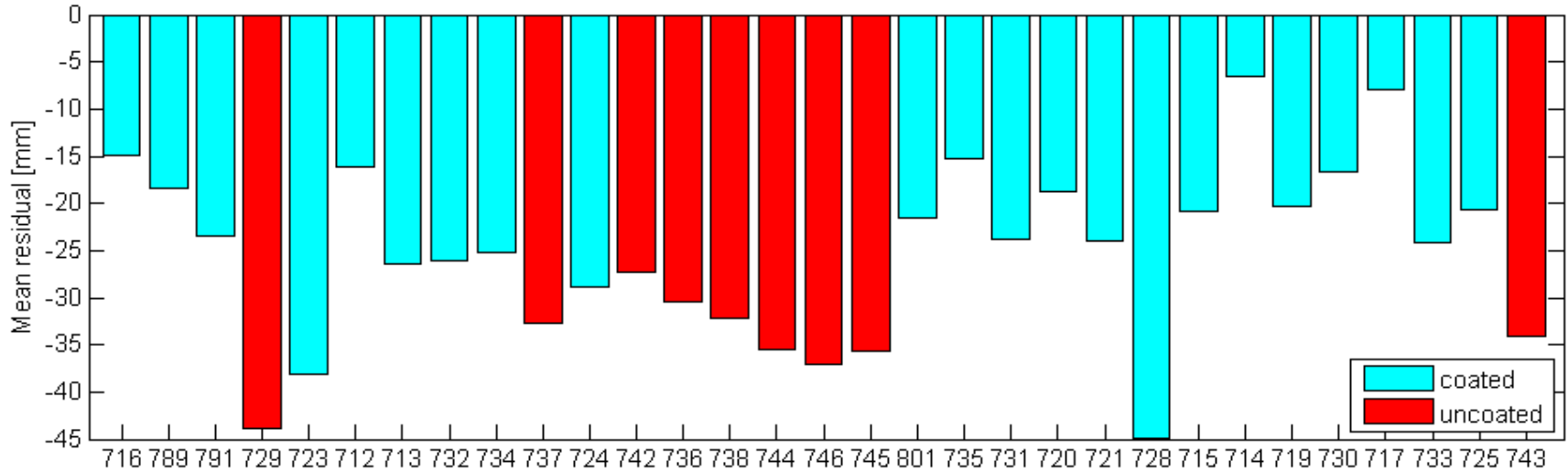


Network

Mean of SLR residuals for station 7810 14001S007



Mean of SLR residuals for station 7090 50107M001



Analysis

- Observations have to be included in operational analysis and/or reanalysis
- Special Analysis/Combination Centers needed?
- Is the analysis organized and coordinated by the ILRS, IGS or IERS?
- AC must be able to generate GNSS solutions at high-quality level (i.e. similar to IGS Analysis Centers)
- Multi-GNSS analysis is required
- Cooperation with IERS Working Group „Combination at Observation Level (COL)“

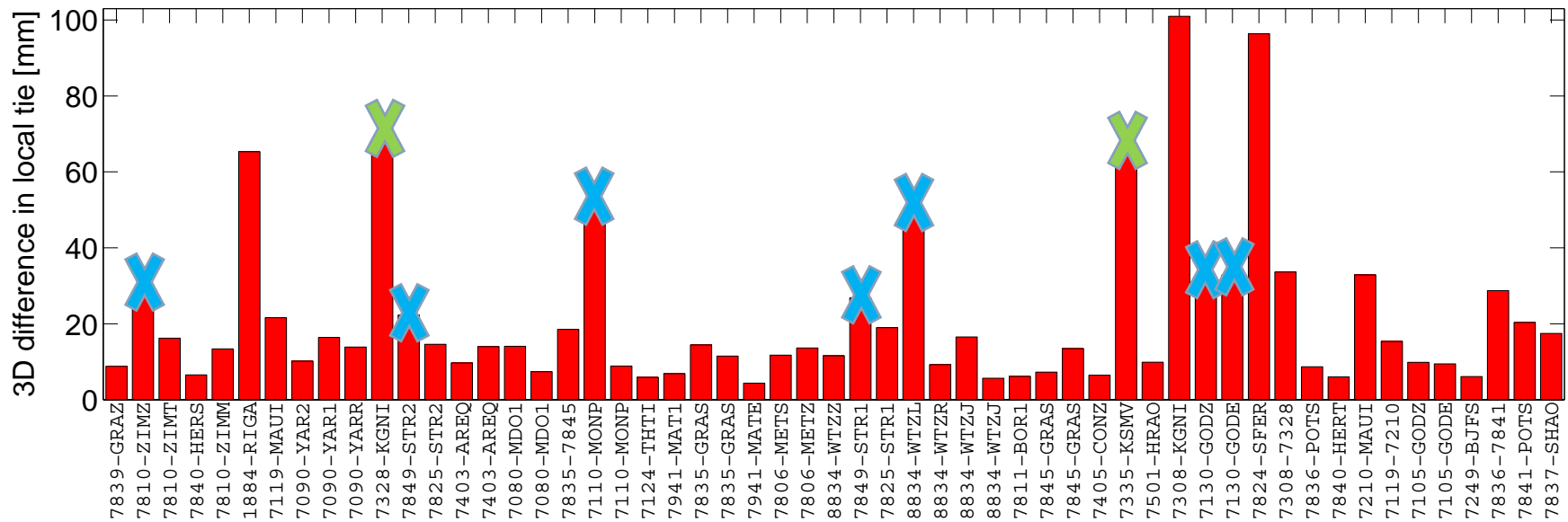
Impact on IERS Products

- ITRF:
 - Geocenter
 - Scale
 - Station-specific range biases have to be calibrated
 - Satellite antenna offsets (MW and SLR reflector) have to be calibrated
 - Local Ties can be validated
 - Pre-combined solutions to be included into ITRF computations (first experiences along with ITRF2013)
 - Requires consistent re-analysis every few years

- Earth Rotation:
 - Connection of GNSS and SLR via common orbits -> orientation
 - Pre-combined solutions to be included into IERS EOP Products
 - Requires operational pre-combined products (daily or weekly)

Local Ties: Validation

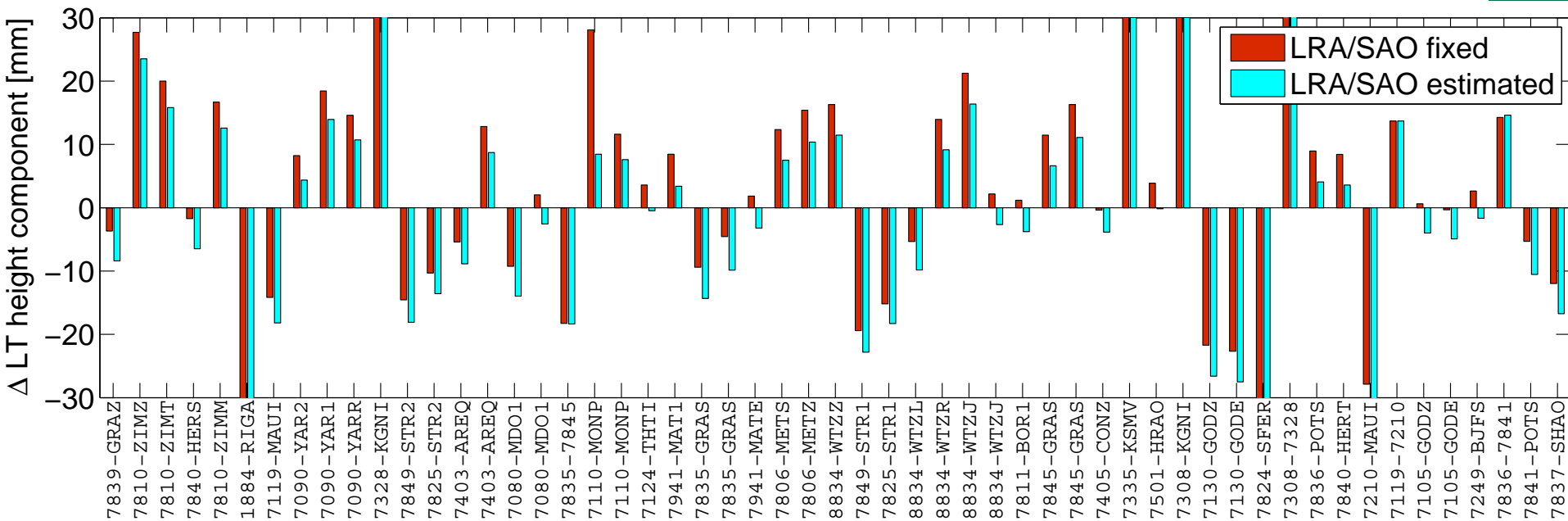
- X Less than 3 years observation time
- X GNSS and SLR never in parallel



3-D agreement:

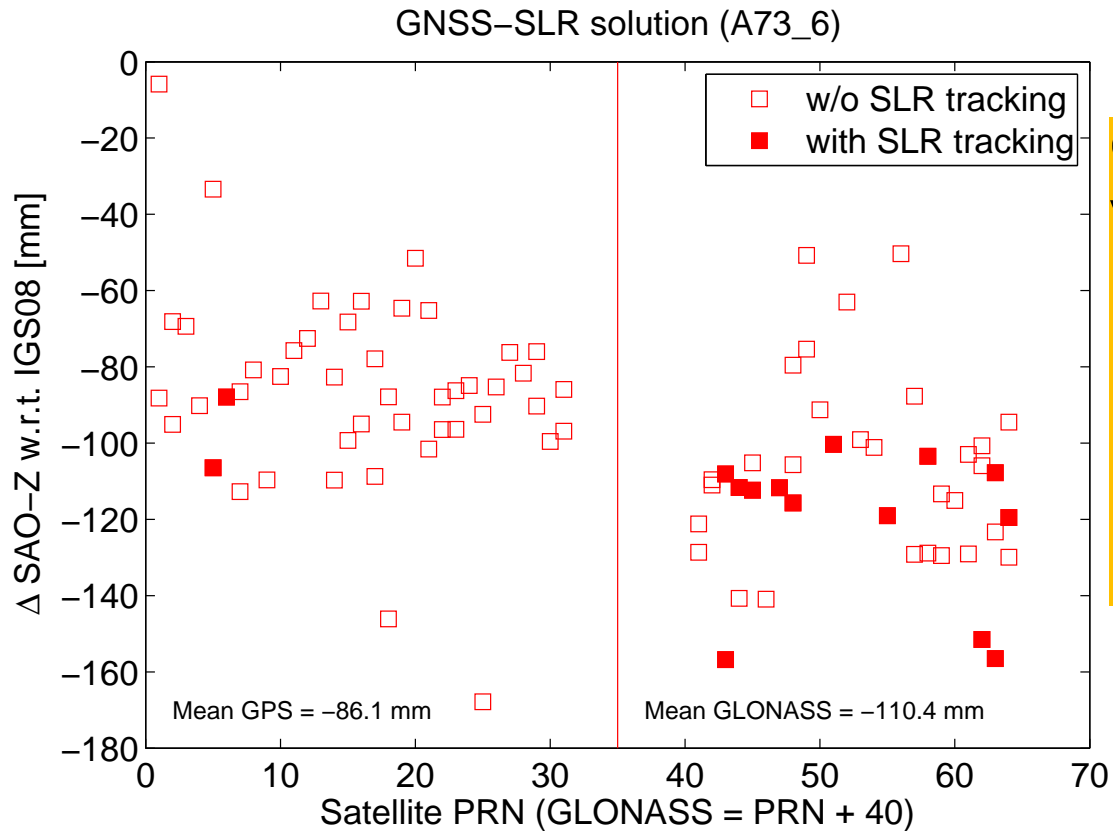
$0 \text{ mm} < \Delta \leq 10 \text{ mm}$	17 co-locations
$10 \text{ mm} < \Delta \leq 20 \text{ mm}$	13 co-locations
$20 \text{ mm} < \Delta \leq 30 \text{ mm}$	5 co-locations
$30 \text{ mm} < \Delta$	15 co-locations

Local Ties: Validation



- Corrected «Space Ties» (LRA, SAO) improve consistency with «Local Ties»:
- **27 LT** better than 1 cm **WITH** corrected «Space Ties»
- **24 LT** better than 1 cm **WITHOUT** corrected «Space Ties»
- Local Ties and Space Ties validate each other

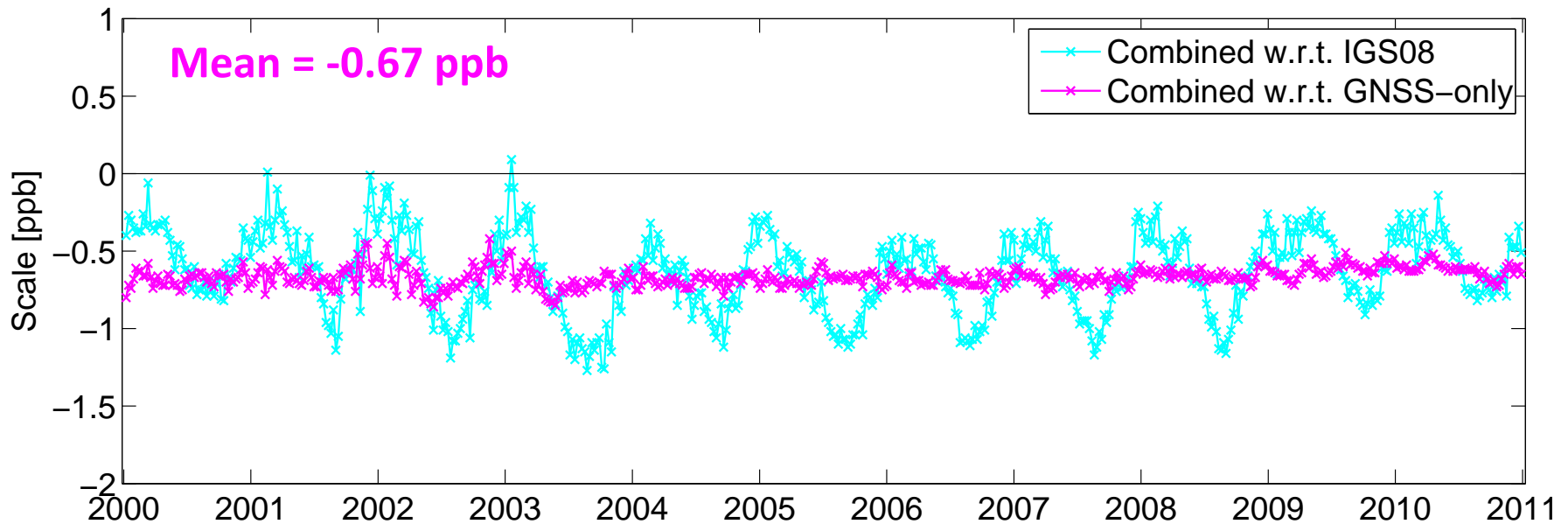
Ties at Satellites



Corrections to IGS08 values:

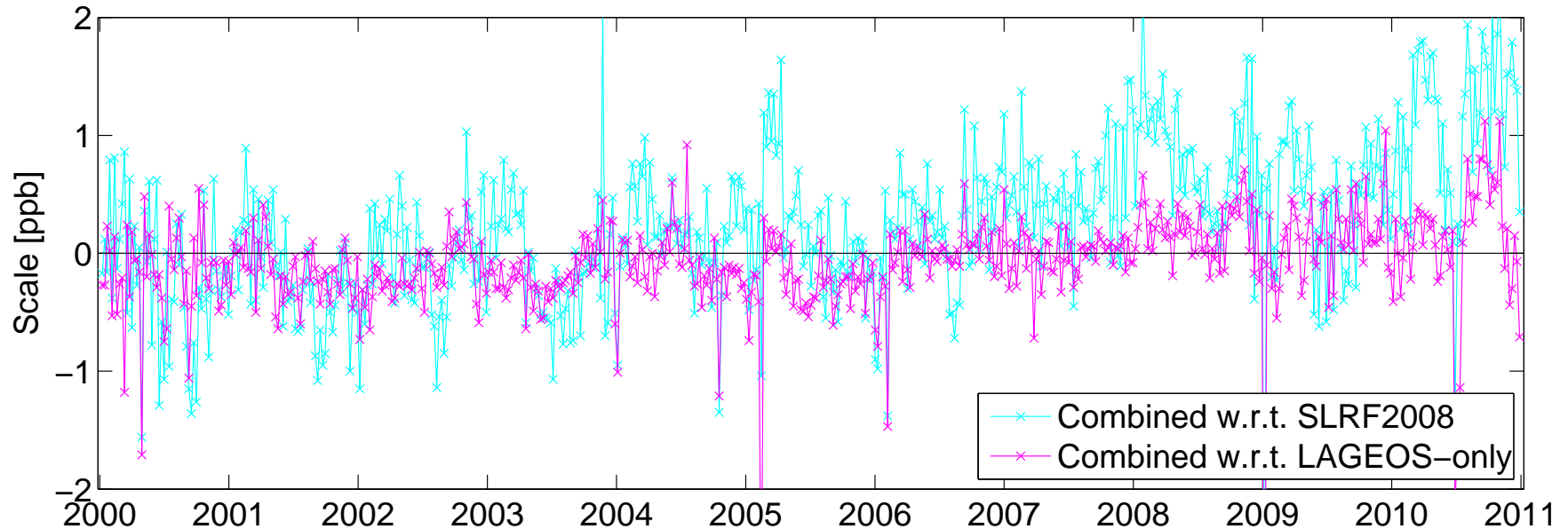
GPS: -86.1 mm
GLONASS: -110.4 mm

Scale: SLR and GNSS



- Z-SAO is correlated with scale: $\Delta\text{Scale [ppb]} = -7.8 \cdot \Delta\text{SAO}_z \text{ [m]}$
- $\Delta\text{SAO}_z \text{ (GPS)} = -86.1 \text{ mm} \Rightarrow \Delta\text{scale} = 0.67 \text{ ppb}$
- $\Delta\text{SAO}_z \text{ (GLONASS)} = -110.4 \text{ mm} \Rightarrow \Delta\text{scale} = 0.86 \text{ ppb}$
- **SAO corrections are absorbed by the GNSS network scale**

Scale: SLR and GNSS



- No systematic scale difference for the SLR network
- Scale from SLR is transferred to the combined solution
- **SAO corrections are fully consistent to the SLR scale**

Thank you for your attention!

Contact:

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Section G1

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